THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. DEGREE PROGRAMME: LEVEL 04
CLOSED BOOK TEST: 2010/2011
CSU2279: DATA STRUCTURES AND ALGORITHMS

DURATION: **ONE AND HALF HOURS** (1 ½ HOURS)

Date: **29th April, 2011** Time: **4.00 pm – 5.30 pm**

Answer ALL Questions.

Q1.

a) Create a binary tree using the following values.

120, 60, 165, 78, 44, 180, 172, 56, 71, 47, 130, 37, 15, 135

i. What is the *depth* of this tree?

ii. What is the *level* of 56?

iii. What is the *degree* of 180?

iv. What are the *leaf nodes* of your tree diagram?

v. Give all the *ancestors* of 37.

vi. Give all the *descendants* of 78.

vii. Is the above binary tree a strictly binary tree? Justify your answer.

viii. Does 130 has a *sibling*? If it has, give the value of it.

ix. What will be the result if the root of the above tree is removed? Clearly draw the resultant diagram.

b) Give the outputs of Preorder, Inorder and Postorder traversals of the above tree.

c) Represent the following algebraic equation as a binary tree.

(((a - b) + (c * (d + e))) $ ((f / g) * h))

d) Write a procedure to insert a right child X, to a tree structure.

e) Write a procedure for postorder traversal.

Q2.

a) State the differences between internal sorting methods and external sorting methods.

b) What are the advantages of advanced internal sorting algorithms than simple internal sorting algorithms? Give an example for advanced sorting algorithms.

c) Name three simple internal sorting algorithms and give one example for each of them.

d) Write a sorting algorithm which sort by exchange.

e) The scores of five Indian batsmen in the ICC world cup 2011final are given below.

Name	Runs
Virender Sehwag	0
Sachin Ramesh Tendulkar	18
Gautam Gambhir	97
Virat Kohli	35
Mahendra Singh Dhoni	91

i. Sort the players in alphabetic order by using their last name. Use the sorting algorithm given as the answer for part (d) for this purpose. (Write all steps clearly)

ii. Sort the players by using their runs in ascending order. Use linear insertion sorting algorithm.

Q3.

a) Searching methods can be classified according to different criteria. Name them.

b) What are the three kinds of variations of sequential searching methods?

c)

i. What are the factors that the running time of an algorithm depends on?

ii. Perform a Big- O analysis for the following function.

$$\frac{10(n-1)(n+1)}{5(n-1)}$$

iii. What are the two notations used to discuss growth rate. Differentiate among these two notations.

d) Consider the following function.

```
Function fact (i: integer): integer;
Begin
    fact: = 0;
        if I <=0 then
             fact: = 1
        else
             fact: = I * fact (i - 1);
End;
```

i. What are the differences between '*Recursive*' and '*Non recursive*' algorithms?

ii. Write a non recursive algorithm for the function given above.

iii. Calculate the running times of the *recursive* and *non recursive* algorithms.

e)

i. What is a set?

ii. What are the two representations of sets?

f) S1 = {1, 3, 5, 6, 8}
S2 = {0, 1, 2, 3, 4, 5, 9}

Using the above given two sets find the following by using appropriate diagrams.

i. Set union

ii. Set difference (S1 – S2)

iii. Set intersection